REMARKS

Summary of Amendments

The specification has been amended to correct the instances in which the Greek letter *mu* (μ) before "m"—meant to indicate micron units following given numerical values—is garbled. These amendments amount to formal corrections only; of course no new matter has been added. The illegibility of "μ" would seem to be an artifact of the submission of the present application by means of the USPTO's Electronic Filing System. When Applicant's representative submitted the present application, versions of the specification printed out via browser display and via "ePAVE" (the USPTO's proprietary electronic submission software), and still viewable, on Applicant's end contained no illegible text.

Claim 1 has been amended, and claims 2-4 remain in their original form.

Rejections under 35 U.S.C. § 103

Claims 1-4 were rejected as being unpatentable over U.S. Pat. No. 5,688,331 to Aruga et al., or in the alternative, over U.S. Pat. No. 6,160,244 to Ohashi.

In making this lone rejection, the present Office action acknowledges, "neither Aruga et al. nor Ohashi explicitly shows the claimed distance where the distance between the central axis of the shaft and the center of the substrate is 5% or less." Then, to make a *prima facie* case of obviousness, the Office action presents the combination of either Aruga et al. or Ohashi with the assertion, "It would have been obvious to have the supporting shaft at the center of the substrate, and further have the central axis of the shaft come within the claimed distance or less, so that the support shaft can uniformly support and balance the substrate on its supporting shaft, since having the misaligned central axis would tilt the substrate one way or the other, as the weight of the substrate is imbalanced on the supporting shaft."

This assertion made in combination with either the Aruga et al. or the Ohashi disclosures is appears to be based on the assumption that in the present invention the goal of the relationship between the shaft center axis and the substrate axial center is to keep the substrate balanced on the supporting shaft. Nevertheless, this assumption is not the object of the present invention. The goal of the present invention is temperature uniformity (isothermal quality) in the wafer-carrying side of a wafer-holder substrate, not mechanical balance in a wafer holder substrate on a support shaft.

In particular, the goal of the present invention is to achieve a temperature distribution that is at least within ±1.0% in the wafer-carrying side of a wafer holder that can hold scaled-up substrates (substrates on the order of 12 inches in diameter).

To achieve that goal, the present invention provides, as now set forth in claim 1,

a wafer holder comprising:
a substrate having a wafer-carrying side; and
a substrate-supporting shaft, said shaft being joined to said substrate such that a distance *a* between the center axis of said shaft and the axial center of said wafer-carrying side of said substrate is 5% or less of the diameter *L* of the wafer-carrying side, and said shaft being of a substance whose difference in thermal expansion coefficient with the wafer holder is 5×10^{-6} K or less, such that temperature distribution in the wafer-carrying side of said substrate is within ±1.0%.

Both Aruga et al. and Ohashi references are directed to the same problem as is the present invention—temperature uniformity in the process-object carrying side of a susceptor. But the Aruga et al. and Ohashi references address this problem in ways that are completely different from the way the present invention does.

In their first embodiment, Aruga et al. mention temperature uniformity only to say (column 4, lines 25-30), "Since aluminum nitride, which has the same degree of heat conductivity as aluminum, is used as the susceptor wafer support plate 39, the susceptor wafer support plate surface can achieve the same temperature uniformity as if it were made of aluminum." In their second embodiment Aruga et al. address the temperature-uniformity issue by focusing on reduction of thermal losses from the support stem 120 that supports the wafer support plate assembly 100. In particular, the stem 120 is fluted so as to reduce its cross-sectional area in order to reduce thermal energy conducted away from wafer support plate assembly 100, thus reducing thermal energy lost due to conduction down the stem 120.

And Aruga et al. only mention thermal expansion coefficient in discussing (column 7, lines 8-15) aluminum nitride protective coatings for alumina or silicon carbide susceptors. Aruga et al. are silent on the relation between thermal expansion coefficient of the substrate and of the support shaft for a wafer holder. Moreover, Aruga et al. are silent on the relationship between the shaft center axis and the substrate axial center.

It is respectfully submitted that the combination of the Aruga et al. teachings with the Office action assertion of the obviousness of ensuring the central axes of the supporting shaft and substrate are not misaligned, so as to keep the substrate from

tilting and thus uniformly support and balance the substrate on the supporting shaft, would not lead to the invention as set forth in claim 1 by the combination of:

> a substrate, and a substrate-supporting shaft joined to the substrate, with the distance between the shaft center axis and the substrate axial center being 5% or less of the diameter of the substrate wafer-carrying side, and with shaft being of a substance whose difference in thermal expansion coefficient with the wafer holder is 5×10^{-6} K or less, so as to bring temperature distribution in the substrate wafer-carrying side to within ±1.0%.

Ohashi addresses temperature distribution in the heating surface of the susceptor by employing first and second "heat-choking portions"—7A and 25A in Fig. 1—plus a "back plate" 8 to restrict flow of heat to the supporting pipe 12. It is to be noted that the heat-choking portion 7A intervenes between the susceptor 1A and the supporting pipe 12. (In the present invention, the supporting shaft is joined directly to the substrate.)

And similarly to Aruga et al., Ohashi only mentions thermal expansion coefficient in discussing (column 6, lines 10-14) a protective film coating the susceptor 1A, back plate 8, and supporting pipe 12, where he states, "It is preferable that a difference in a coefficient of thermal expansion between the constituent members of the susceptor and the film therefor is not more than 1×10^{-6}/°C from the standpoint of the heat-resistant cycling of the susceptor."

Ohashi is silent on the relation between thermal expansion coefficient of the substrate and of the support shaft for a wafer holder. Moreover, Ohashi is silent on the relationship between the shaft center axis and the substrate axial center.

It is respectfully submitted that the combination of the Ohashi teachings with the Office action assertion of the obviousness of ensuring the central axes of the supporting shaft and substrate are not misaligned, so as to keep the substrate from tilting and thus uniformly support and balance the substrate on the supporting shaft, would not lead to the invention as set forth in claim 1 by the combination of:

> a substrate, and a substrate-supporting shaft joined to the substrate, with the distance between the shaft center axis and the substrate axial center being 5% or less of the diameter of the substrate wafer-carrying side, and with shaft being of a substance whose difference in thermal expansion coefficient with the wafer holder is 5×10^{-6} K or less, so as to bring temperature distribution in the substrate wafer-carrying side to within ±1.0%.

Accordingly, Applicant courteously urges that this application is in condition for allowance. Reconsideration and withdrawal of the rejections is requested. Favorable action by the Examiner at an early date is solicited.

Respectfully submitted,

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James W. Judge
Registration No. 42,701

JUDGE PATENT FIRM
Rivière Shukugawa 3rd Fl.
3-1 Wakamatsu-cho
Nishinomiya-shi, Hyogo 662-0035
JAPAN

Telephone: 305-938-7119
Voicemail/Fax: 703-997-4565